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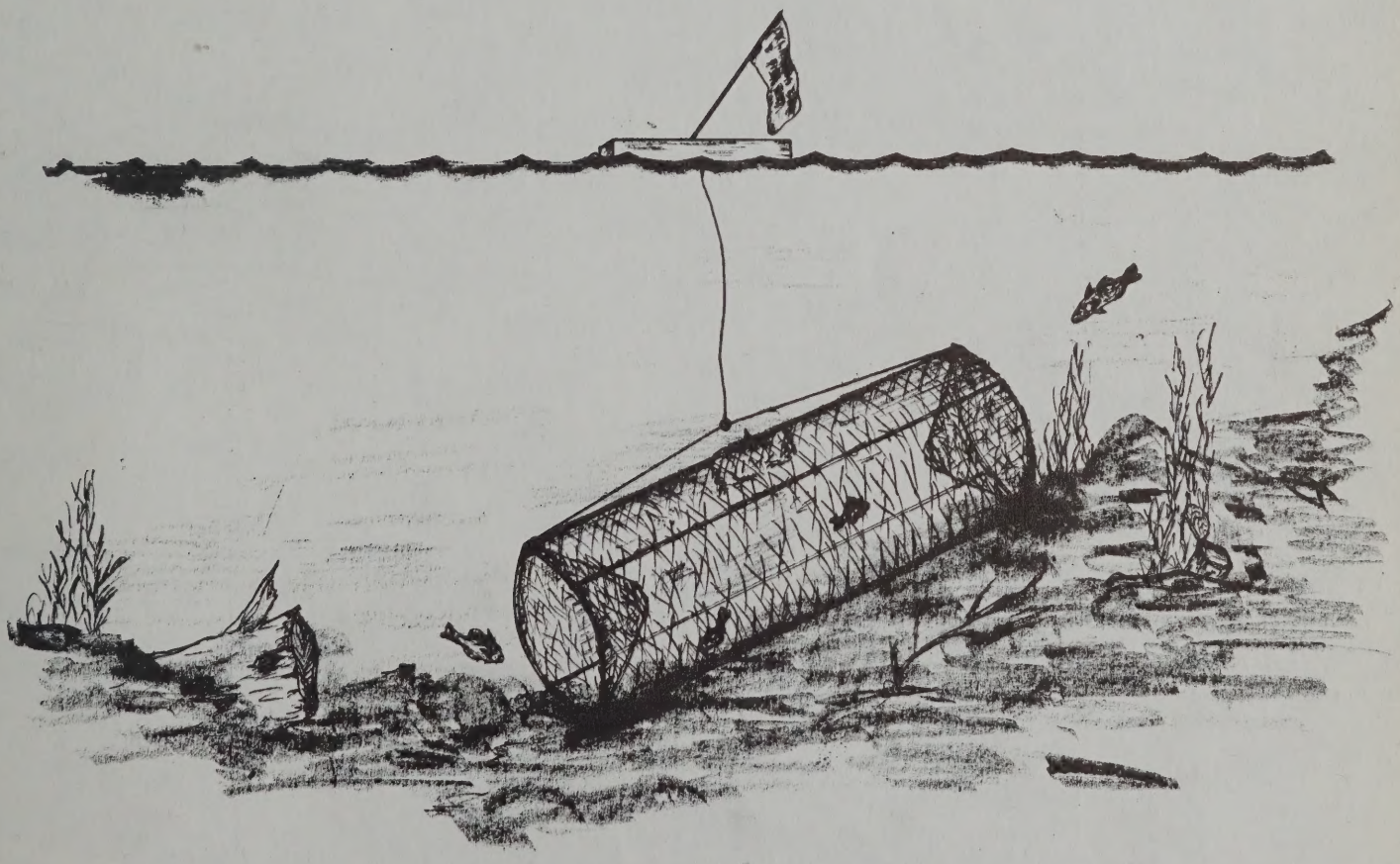
A SUMMARY OF FISH POPULATION STUDIES CONDUCTED DURING 1954 AT

ARDMORE CITY LAKE, STRINGTOWN SUB-PRISON LAKE, FAIRFAX CITY LAKE, AND PAWHUSKA CITY LAKE

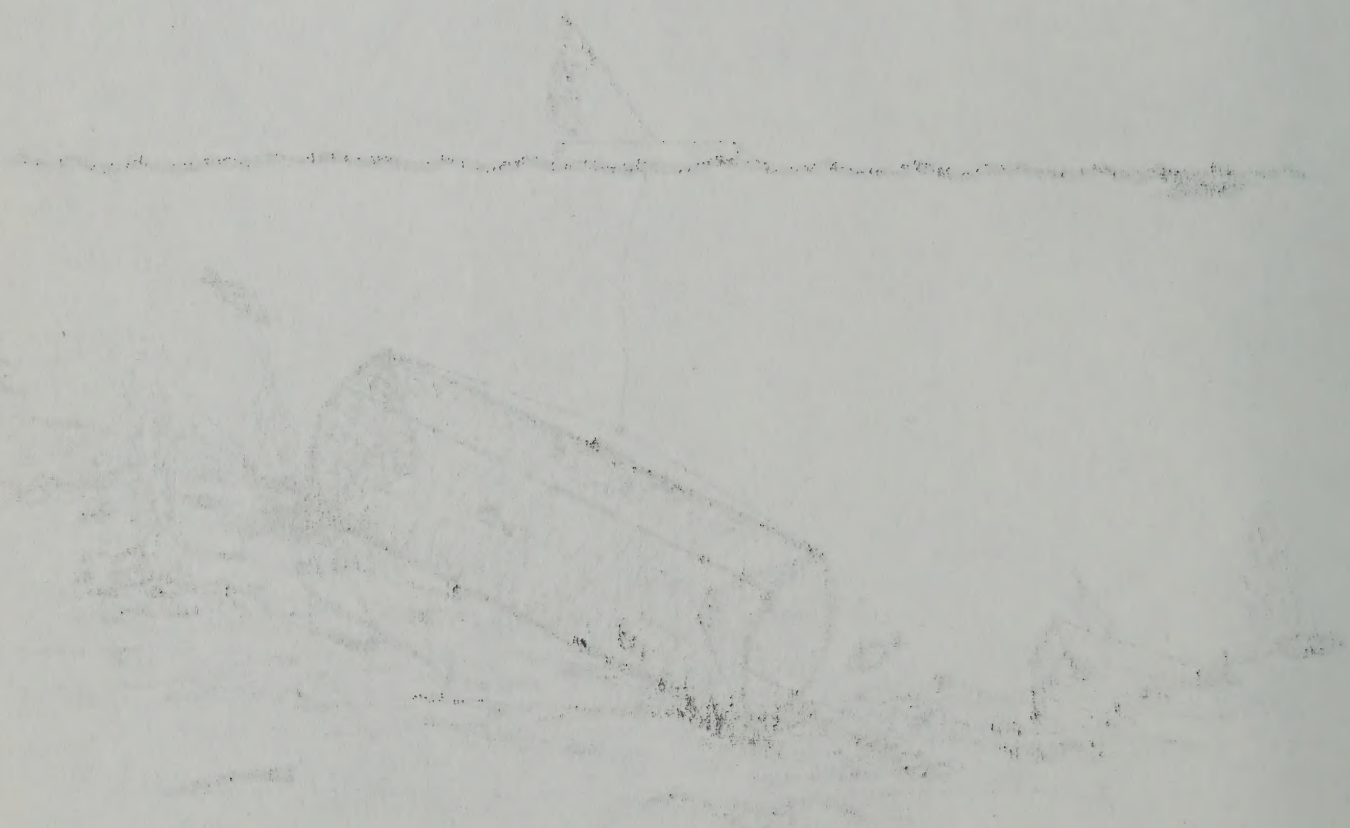


Oklahoma Fisheries Research Laboratory Report Number 48

March, 1955

Norman, Oklahoma

OCT 3 1 1956



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Special recognition is due Mr. Don Hutson, Pawhuska City Lake Custodian, who continued trapping operations from August 7 to August 20, following the departure of the survey crew. Hearty voluntary cooperation of that measure is rare indeed, and constitutes a real aid to the research program.

A SUMMARY OF FISH POPULATION STUDIES CONDUCTED IN 1954 AT ARDMORE CITY LAKE, STRINGTOWN SUB-PRISON LAKE, FAIRFAX CITY LAKE, and PAWHUSKA CITY LAKE

by

Robert M. Jenkins

Quantitative fish population analysis by the mark and recapture method was undertaken initially in Oklahoma in the summer of 1954. Wire traps were utilized successfully, with seines and the use of rotenone supplementing this procedure at some lakes. The four principal lakes studied ranged from 60 to 184 acres in size, and all served as water supplies. Lack of adequate equipment and incomplete knowledge of proper techniques to apply at each lake produced incomplete estimates in many instances, but the experience gained was of real value in planning future population studies.

This summary is a preliminary report of the results obtained following 16 to 27 days of trapping at each of the four lakes, and is intended to serve as background material for continued investigations in 1955.

MATERIALS AND METHODS

Cylindrical traps, six feet long and three feet in diameter, with two six-inch throats, were used in capturing fish. The framework was made of 3/8" reinforcing rod, and covered with 1-inch mesh chicken wire. Traps were marked with

wooden floats attached with heavy sash cord. Fifteen to twenty-four traps were fished in each lake during a three-week period, and were normally lifted daily for 16 consecutive days. Trapped fish were measured individually, marked by clipping the left or right pectoral fin close to the base, and returned to the water at a central release point from a canvas holding "tub". Marking was carried on continuously until the last two days of sampling, when catches were retained for scale samples and length-weight measurements.

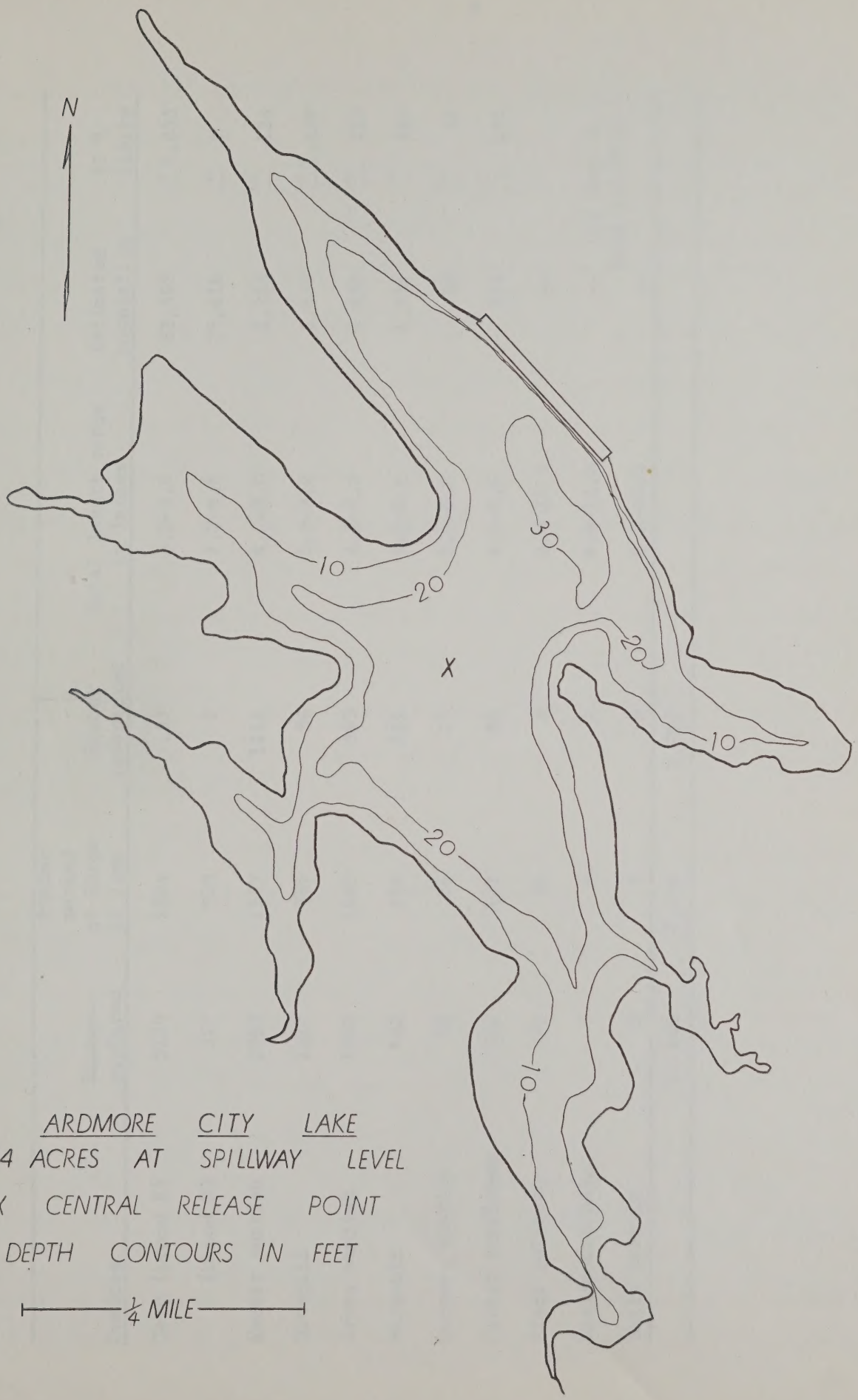
One ½-inch mesh seine, 100 feet long and 8 feet deep, was used with varying degrees of success at each lake. Thick shoreline vegetation, steep and rocky shores, and stumps and brush thwarted seining attempts at all lakes except Stringtown. Experience indicated that a one-inch mesh seine about 300 feet long and 12 feet deep at the center would be required to adequately sample lakes in the 50-200 acre size range.

Traps were fished above oxygen deficient water in all lakes, and were normally placed in more than six feet of water. Typically they were set within 100 feet of the shore in 9 to 17 feet of water.

Population estimates are based on the formula presented by Schnabel (1938), unless otherwise stated. Ninety-five percent confidence limits were based on the assumption of Poisson distribution, wherein the variance is equal to the summation of recaptures.

Ardmore City Lake

Trapping, marking, and releasing of fishes was carried on in 184-acre Ardmore City Lake (Figure 1) from 9 to 25 June, 1954, nine months following partial population removal. Population estimates (Tables 1 and 2) indicated an extremely high population of young-of-the-year carp, a reduced but ample sunfish population, and very few adult crappie, largemouth bass, channel catfish, and gizzard shad.



ARDMORE CITY LAKE
184 ACRES AT SPILLWAY LEVEL
X CENTRAL RELEASE POINT
DEPTH CONTOURS IN FEET
¼ MILE

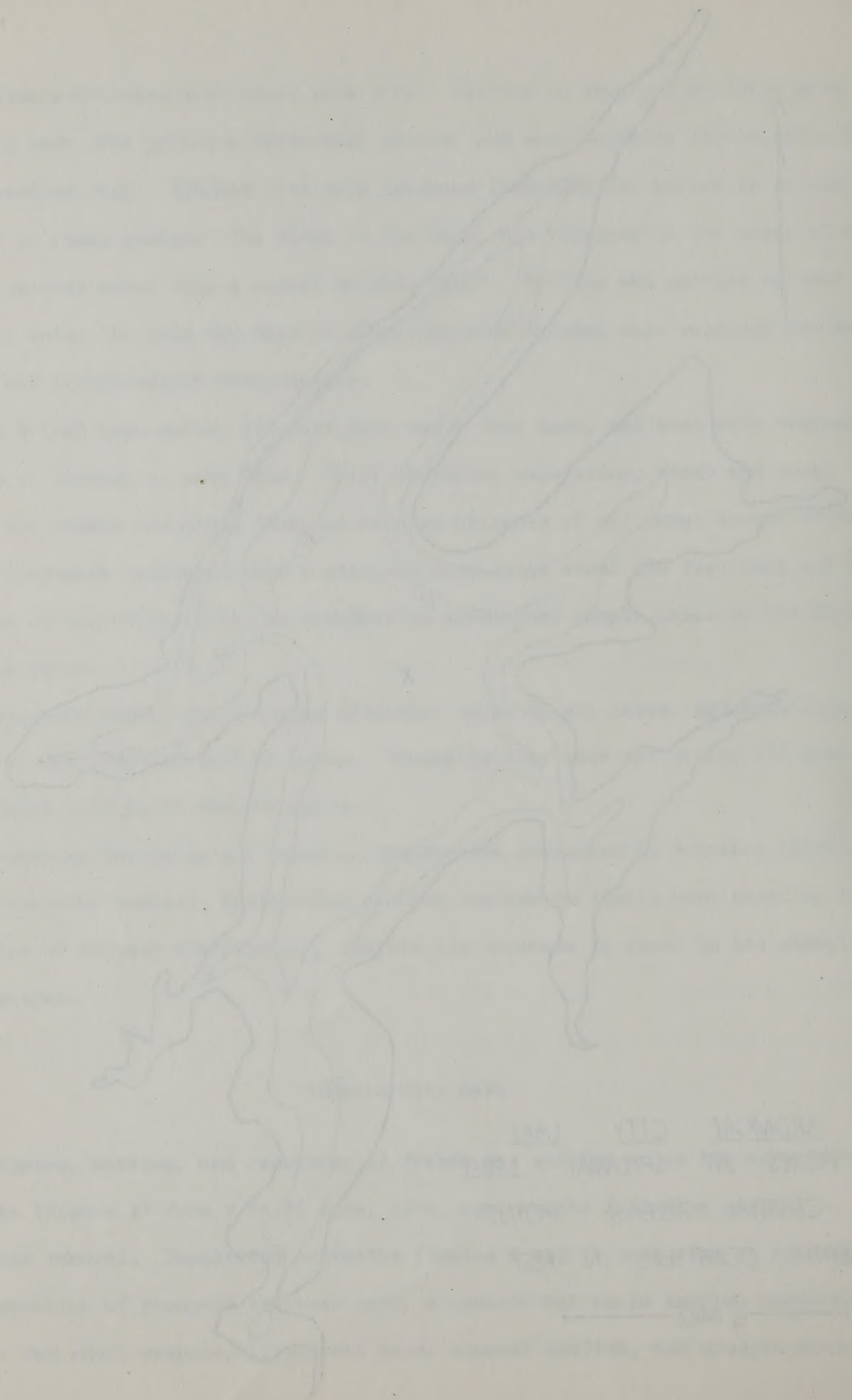


Table 1. Summary of trap and seine catches in Ardmore City Lake 9-25 June 1954. Population estimates based on trap catches (401 trap lifts).

Species	Number captured	Number marked at large 25 June	Number recaptured	Total length range in inches	Estimated population	95 % limits
Carp (brood A)	3139	2904	133	5.2-9.6	33,383	±6,833
(brood B)	527	390	2	3.2-6.5	25,416	± ?
Redear sunfish	2889	1597	1212	4.0-9.0	2,253	± 134
Bluegill	1117	995	94	3.4-9.2	5,637	±1,428
Green sunfish	1598	1095	399	4.2-8.8	2,435	± 263
Warmouth	642	469	131	4.0-9.6	1,224	± 250
Longear sunfish	53	36	17	3.4-6.0	59	± 52
Hybrid sunfishes	131	101	30	4.3-7.8	220	± 122
Black bullhead	78	75	3	6.0-15.9	--	
Largemouth bass	7	6	1	4.8-11.3	--	(11 hook & line 4.1-9.0)
White crappie	8	8	0	6.5-10.5	--	
	10,189	7,676	2,022			

Table 2. Population estimates of various fishes in Ardmore City Lake, 9-25 June 1954, by three different formulae.

Species	Schnabel[1] (95%)	Chapman[2] (95%)	Schumacher & Eschmeyer[3] (68%)
Carp (Brood "A" B/P = 0.09	33,383 ± 6,833	39,109 ± 7,134	31,177 ± 2,726
Redear B/P = 0.71	2,253 ± 134	2,268 ± 80	2,273 ± 57
Bluegill B/P = 0.18	5,637 ± 1,428	6,726 ± 1,517	5,471 ± 418
Green sunfish B/P = 0.45	2,435 ± 263	2,830 ± 314	2,558 ± 151
Warmouth B/P = 0.38	1,224 ± 250	1,480 ± 239	1,360 ± 49

	Population Estimate	Confidence Limits
(1) Schnabel --	$\hat{P} = \frac{\Sigma AB}{\Sigma C}$	$s = \sqrt{V}$ Variance = ΣC assuming Poisson distribution; $(s)\ (1.96)$
(2) Chapman --	$\hat{P} = \frac{\Sigma\left(\frac{AB}{C}\right)\left(\frac{AB}{A-C}\right)\left(\frac{AB}{B-C}\right)}{\Sigma\left(\frac{AB}{A-C}\right)\left(\frac{AB}{B-C}\right)}$	$s^2 = \frac{P}{\Sigma\left(\frac{A}{P-A}\right)\left(\frac{B}{P-B}\right)}$ (normal - hypergeometric distribution)
(3) Schumacher & Eschmeyer --	$\hat{P} = \frac{\Sigma AB^2}{\Sigma BC}$	$s^2 = \frac{1}{k-1}\left(\Sigma\frac{C^2}{A} - \frac{\Sigma BC}{P}\right)$; $s = P\sqrt{\frac{Ps^2}{BC}}$

Schnabel, Zoe Emily. 1938. Estimation of Total Fish Population of a Lake. Am. Math. Monthly, 45(6): 348-52.

Chapman, Douglas G. 1951. Some Properties of the Hypergeometric Distribution with Applications to Zoological Censuses. Univ. Calif. Publ. in Statistics, 1(7):131-60.

Schumacher, F. X., and R. W. Eschmeyer. 1943. The Estimate of Fish Population in Lakes or Ponds. Journ. Tenn. Acad. Sci., 18(3): 228-49.

The population of stunted yellow perch which existed in 1953 was apparently completely eradicated.

Age-group 0 carp were estimated to number about 60,000, with a total weight of 630 pounds/acre, on 23 June (Figure 2). Estimates were complicated by recruitment (Figure 3), attributed to the existence of two distinct, fast-growing, size groups. Growth in length of "brood A" amounted to 0.1 inch/day (Figure 4).

Bluegill, redear, warmouth, and green sunfish were growing at an accelerated rate, and were in excellent condition. Seining revealed large numbers of young-of-year largemouth bass, white and black crappie, black bullhead, and gizzard shad. Channel catfish reproduction was not evident. Population estimates of "brood A" carp, redear, bluegill, green sunfish, and warmouth (Table 2) were statistically reliable. A surprising 70 percent of the redear sunfish over four inches long estimated to be present were captured, marked, and returned to the lake. Forty-five percent of the green sunfish, 38 percent of the warmouth, 18 percent of the bluegill, and 9 percent of the "brood A" carp were estimated to have been caught and fin-clipped.

To establish the influence of homing tendency, all fish captured south of the central release point (Figure 1) were marked by clipping the left pectoral fin, and those in the north half by the right pectoral fin. Recaptures indicated a definite homing tendency (Table 2a), with an excess of 27.4 percent returning to the home half. Due to 1) the dendritic shape of the lake, which necessitated placing traps at greatly varying distances from the release point; 2) that over two-thirds of the fish were caught in the south half; and, 3) that four-five traps located in the south half were closest to the release point, this tendency could not be properly evaluated. Traps were moved about throughout the period, and a home "station" tendency analysis could not be attempted. Population estimates are based on the assumption of random distribution of marked fish.

Table 2a. Homing tendency of fishes captured and released in Ardmore City Lake, June 1954.

Species	Total recaptured	Home half	Opposite half
Carp	135	85	50
Redear sunfish	1212	728	484
Bluegill	94	59	35
Green sunfish	399	288	111
Warmouth	131	90	41
Longear sunfish	17	13	4
Hybrid sunfish	30	22	8
Misc.	4	2	2
Totals	2,022	1,287	735

Trapping was resumed on 8 December and continued until 29 December 1954. During this period 5,010 fish were captured in 285 trap lifts (Table 3), compared to 10,189 in 401 lifts in June. In December the catch consisted primarily of crappies. Low returns reduced the reliability of the population estimate. In June, only one black crappie, measuring 10.5 inches, was marked and released. This individual was recaptured twice during the December trapping period, and had grown 1.1 inches in length. Four additional adult black crappie (9.4-10.6" TL) were trapped in December. Seven white crappie (6.5-10.9" TL) were marked in June. Two adults were captured in December, one (12.1" TL) bearing a June mark. This indicates a very low adult crappie population ($\hat{P} = 19$), which is substantiated by the three winter returns coupled with the known high vulnerability of these species to wire trap capture.

The largemouth bass estimate (Table 3) is unrealistic, and probably attributable to a homing tendency, plus low susceptability to trap capture.

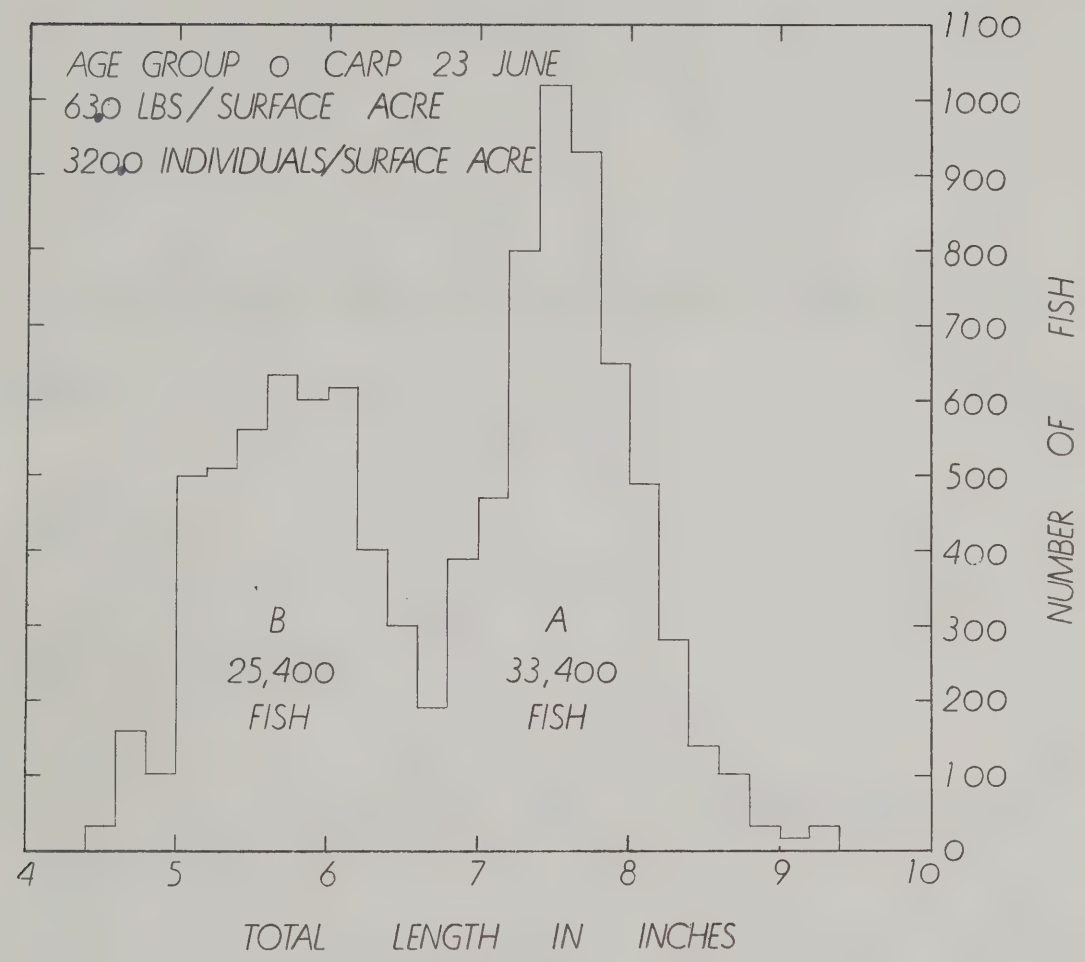


Figure 2. Length-frequency of estimated total population of Age-Group 0 carp in Ardmore City Lake on 23 June 1954. Based on population estimate of "brood A", and relative number of "brood B" in sample from 21-23 June (0.2 inch interval)
Brood "A" individuals approximately 80 days old.
Brood "B" individuals approximately 60 days old.
Weight increase approximately 0.8 lbs/day/surface acre.

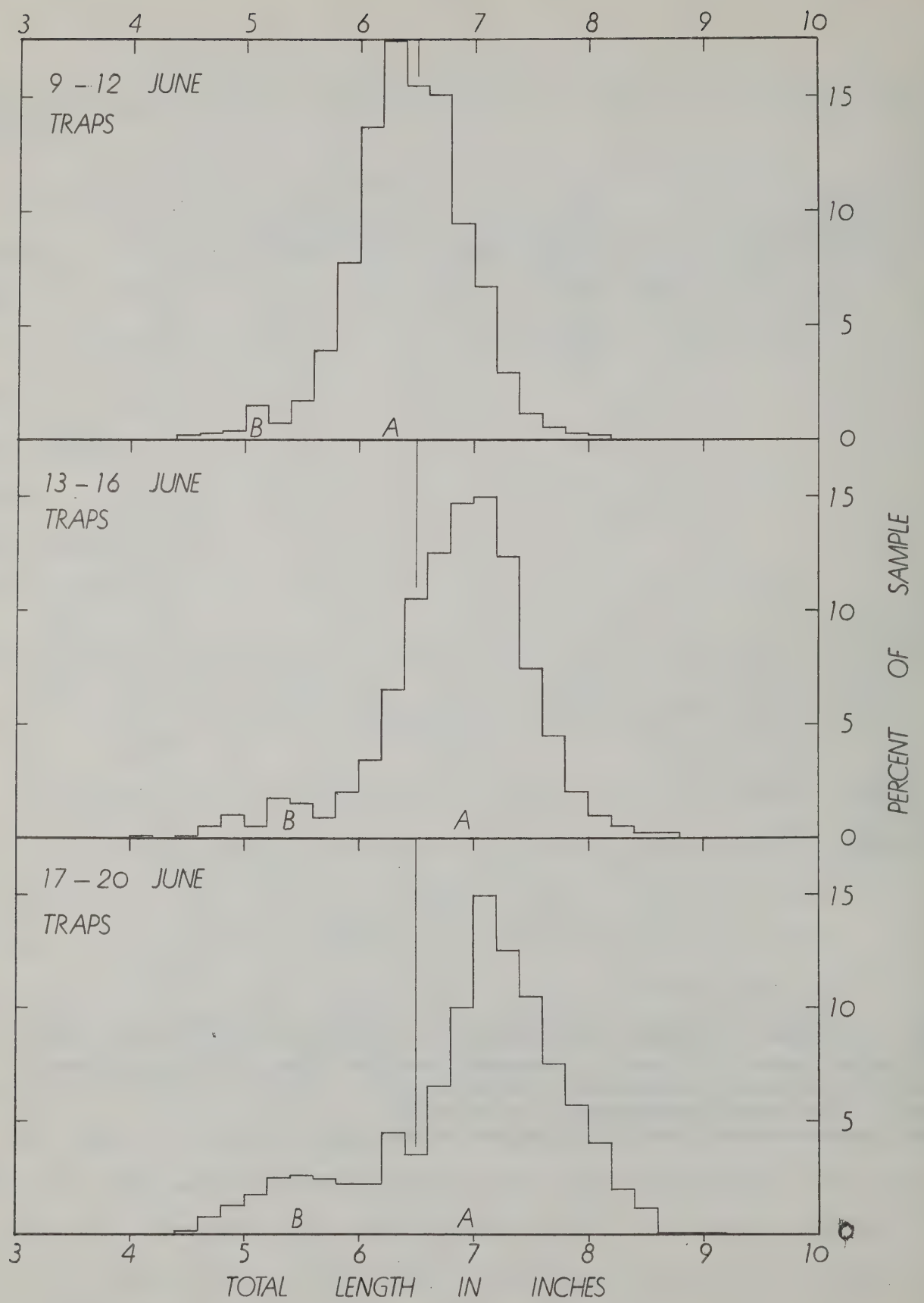

9 – 12 JUNE
TRAPS
13 – 16 JUNE
TRAPS
17 – 20 JUNE
TRAPS
A
B
PERCENT OF SAMPLE
TOTAL LENGTH IN INCHES
3
4
5
6
7
8
9
10
0
5
10
15

Figure 3.

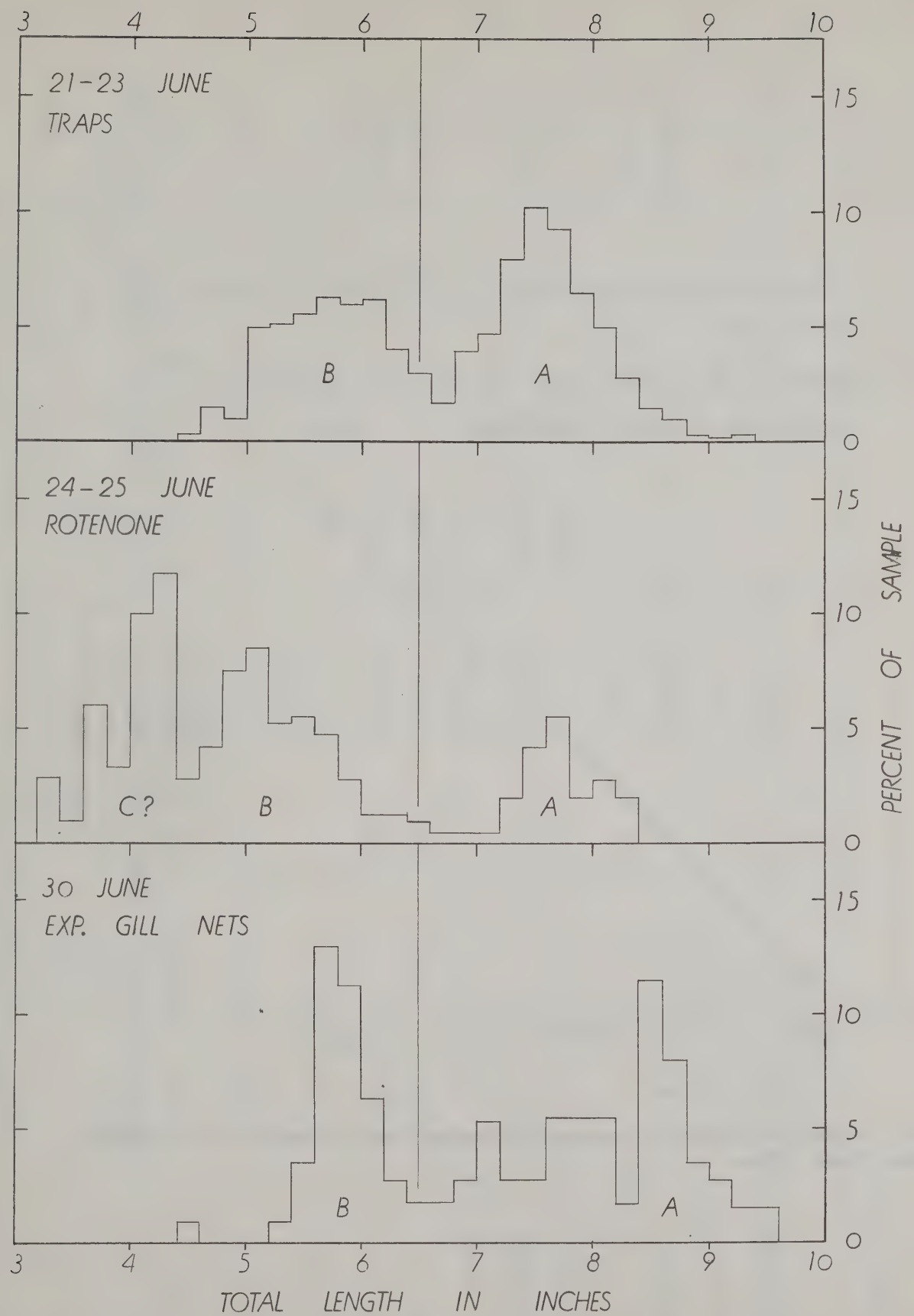


Figure 3. Length-frequency of Age-Group 0 carp, based on percent of total sample during period stated. Fish grouped in 0.2 inch length intervals. A and B indicate two distinct size groups which were evident in sampling by all methods employed.

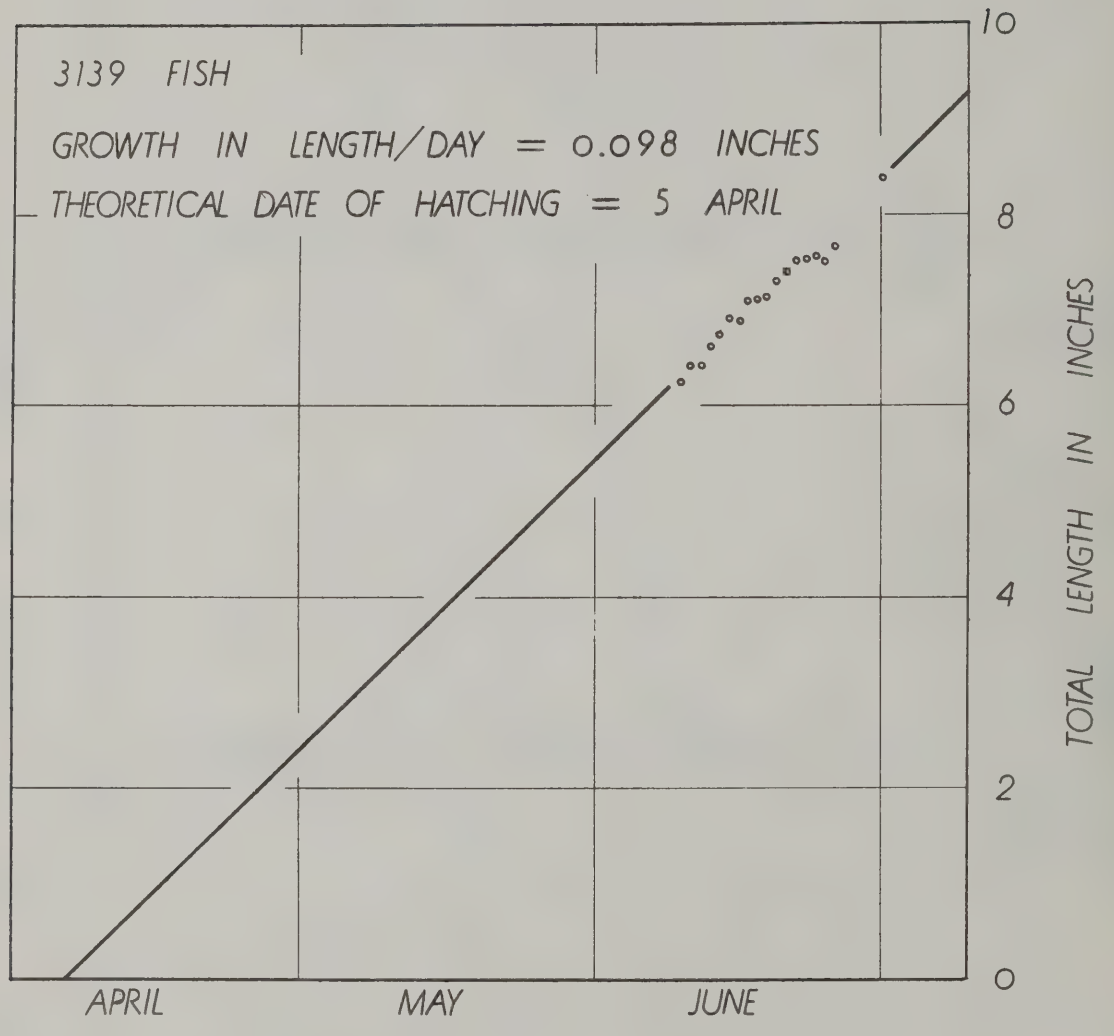


Figure 4. Growth in length of young-of-the-year carp ("brood A") in Ardmore City Lake, June, 1954.

Table 3. Summary of trap and gill net catches in Ardmore City Lake 8-29 December 1954. Population estimates based on trap catches (285 trap lifts).

Species	Number captured	Number marked at large 29 Dec.	Number recaptured	Total length range in inches	Estimated population	95 % limits	Gill net catches (removed) Number	Gill net catches (removed) Length-range
Black crappie	3,180	2,893	19	4.1-11.6 (4.1-5.8)	205,000	± 175,000	143	4.3-5.6
White crappie	1,528	1,216	15	4.4-12.1 (4.4-6.1)	58,400	± 60,000	161	4.5-5.8
Largemouth bass	73	66	7	6.3-13.8	329	± 823	1	15.6
Bluegill	50	48	(1*)	3.7-7.5	(49,750)		2	4.2-5.7
Warmouth	50	45	(2*)	5.2-7.8	(11,725)		1	5.5
Redear sunfish	3	3	0	5.1-6.6	-		-	
Black bullhead	78	70	1 (2*)	6.3-12.9	(2,925)		66	5.9-13.5
Green sunfish	21	18	(3*)	5.7-7.8	(7,665)		-	
Carp	11	11	0	7.8-12.4	-		36	8.2-12.3
Gizzard shad	8	8	0	8.9-9.2	-		40	7.2-10.2
Longear sunfish	3	3	0	4.2-4.4				
Hybrid sunfish	5	5	0	5.7-7.9				
	5,010	4,386	42 8*					

* Summer mark

Table 4. Length-weight relationship of various fishes in Ardmore City Lake, June 1954.

Species		Number of fish	Length range
Redear sunfish	- log W = - 4.0436 + 2.9357 log L	79	4.0-5.7
Bluegill	- log W = - 4.8554 + 3.4361 log L	24	3.9-6.3
Greensunfish	- log W = - 4.2892 + 3.0932 log L	64	4.4-8.1
Warmouth	- log W = - 4.6049 + 3.3194 log L	36	3.5-9.2
Carp	- log W = - 4.1750 + 2.9723 log L	144	4.6-8.6
Black crappie Dec., 1954 (4.3-5.5 inches)	- log W = - 4.6855 + 3.1766 log L	64	4.3-5.5

Based on population estimates (Table 1) and calculated weights (Table 4), there were about 1500 pounds of sunfishes (8.3 pounds/acre), four inches or more in total length, in the lake on 25 June 1954. Based on crude estimates, the population increased to about 7500 pounds (41 pounds/acre) by December. Young-of-the-year white and black crappie increased to an estimated 55 pounds/acre by December. The large carp population evident in June slowed markedly in growth (average = 9.7 inches at end of year), and evidently also experienced a sharp decrease in numbers. Young-of-the-year gizzard shad attained an average length of 9.3 inches during 1954, and such extremely fast growth suggests a relatively low population. The black bullhead population, (6.0 inches +), numbered an estimated 2,925 (approximately 7 pounds/acre).

Trapping operations were resumed in February, and three weeks of intensive sampling is contemplated in June, 1955.

Table 5. Data sheet on population estimate of redear sunfish in Ardmore City Lake, June 1954.

Date	A	B	$\leq$ AB	C	$\leq$ C	$\hat{P}$
9 June	183	-	-	-	-	-
10	219	183	40077	15	15	2,672
11	196	387	115929	38	53	2,187
12	149	544	196985	45	98	2,010
13	144	648	290297	36	134	2,166
14	245	754	475027	82	216	2,199
15	146	917	608909	59	275	2,214
16	250	1004	859909	135	410	2,097
17	327	1119	1225822	155	565	2,170
18	244	1289	1540338	134	699	2,204
19	228	1399	1859310	140	839	2,216
20	133	1487	2057081	86	925	2,224
21	186	1534	2342405	119	1044	2,244
22 AM	88	1600	2483205	55	1099	2,260
22 PM	69	1633	2595882	55	1154	2,249
23	70	1647	2711172	50	1204	2,252
24	12	1597	2730336	8	1212	2,253

B/P = 0.71 $\quad 2{,}253 \pm 134$

A - number of fish captured on any one day

B - number of marked individuals of a particular species present in the lake on that date

C - number of recaptures

Hybrid sunfishes collected in Ardmore City Lake, June, 1954.

Number	Hybrid
36	Warmouth x bluegill
24	Warmouth x green sunfish
22	Bluegill x redear sunfish
10	Bluegill x green sunfish
6	Redear sunfish x green sunfish
5	Warmouth x redear sunfish

Ardmore City Lake - built in 1902

180 surface acres - approximately 2,000 acre-feet
2550 pounds of rotenone applied 18 September 1953
Notes by Clay Wilson, regional biologist, following treatment: "Large shad, carp, and stunted crappie populations; channel catfish and largemouth bass apparently doing well; fairly large bluegill population; absence of cyprinids except carp; only 1 buffalo taken, no flathead catfish; redear sunfish not reproducing well; yellow perch small but abundant."

Ardmore City Lake - 9/18/53 rotenone

Percent of entire sample of various species in age-group ---

	0	I	II	III	IV	V	VI	VII
Largemouth bass		15	33	14	18	14	5	
White crappie	4			62	19	8	3	2
Black crappie				34	52	7	4	3
Channel catfish	2			59	4	2	3	9
Bluegill	2			53	43	2		
Redear sunfish			14	32	52	2		
Yellow perch			57	29	14			
Warmouth	23	4	32	14	23	5		
Average	4%	2%	17%	37%	28%	5%	2%	2%

Assuming random sampling, this indicates profound effect carp have had on total fish population since their ascendancy in 1948. Survival of game and pan species of 1951, 1952, and 1953 year-classes has been almost nil with exception of warmouth and largemouth bass.

(from report written February, 1954)

Table 6. Pre-partial population removal growth-rates of fishes in Ardmore City Lake, 18 September 1953.

Species	Number of fish	Average calculated total length at end of year							
		1	2	3	4	5	6	7	8
White crappie	139	2.1	4.3	6.3	8.5	10.2	11.8	13.0	14.3
Black crappie	29	2.4	5.2	7.4	8.9	11.0	13.3	15.2	
Largemouth bass	221	5.4	9.5	12.8	15.6	17.9	19.7	21.7	
Redear sunfish	63	4.3	6.0	6.9	7.4	8.0			
Bluegill	30	2.7	4.3	5.3	6.3	7.3			
Warmouth	17	3.8	5.6	6.5	7.1	7.7			
Yellow perch	19	2.7	4.9	6.1	6.9				
Carp	30	17.5	24.5	27.7	30.8	32.7			
Gizzard shad	13	6.9	9.9						
Channel catfish	94	4.6	10.1	14.0	15.1	16.3	17.4	18.6	19.6
Black bullhead	2	5.2	8.2						

Table 7. Increase in growth of 1954 year-class fish taken in December 1954 over previous first year growth.

Species	1	Increase
White crappie	5.5	+ 2.4"
Black crappie	5.1	+ 1.7"
Largemouth bass	9.1	+ 3.7"
Bluegill	4.7	+ 2.0"
Warmouth	5.5	+ 1.7"
Carp	9.7	(- 7.8")
Gizzard shad	9.3	+ 2.4"
Black bullhead	6.6	+ 1.4"

Stringtown Sub-Prison Lake

Stringtown Sub-Prison Lake is a 65 acre body of water located on the Stringtown state game refuge in Section 27, Township 1N, Range 12E, Atoka County. The lake was formed by the impoundment of a small, intermittent tributary of North Boggy Creek, and has a drainage area of 1500 acres. The watershed supports vegetation of the tallgrass prairie, post oak-blackjack forest, and oak-pine forest types. The lake averages about 15 feet in depth, with a maximum of 32 feet (Figure 4), and thermo-stratification is pronounced throughout the summer.

The lake has been turbid (visibility 18 inches or less) since draining and reimpoundment in 1951, and there is no submerged aquatic vegetation. pH values ranged from 7.4 to 8.0 during July, 1954.

Population estimates based on trap and rotenone collections (Table 8) indicated a standing crop of 149 pounds per surface acre (Table 9). This production is low in comparison with other state lakes, and is indicative of the low fertility of soils in that region, coupled with a high turbidity. Populations of desirable-sized bass, crappie, and channel catfish were surprisingly high, constituting about one-half of the total weight of all fishes present. Angling success was poor, however, due to high turbidity. Estimates revealed that 53 percent of the stocked channel catfish and 9 percent of the stocked largemouth bass had survived into their fourth summer of life.

Information concerning growth-rates was reported in a paper presented to the Oklahoma Academy of Science in December, 1954, by Joe C. Finnell, entitled "Comparison of growth-rates of fishes in Stringtown Sub-Prison Lake prior to, and three years after draining and restocking."

STRINGTOWN SUBPRISON LAKE

65 ACRES AT SPILLWAY LEVEL

X CENTRAL RELEASE POINT

DEPTH CONTOURS IN FEET

Table 8. Summary of trap and seine catches in Stringtown Sub-Prison Lake 29 June- 14 July, 1954. Population estimates based on trap catches (384 trap lifts).

Species	Number captured	Number marked at large 15 Jul.	Number recaptured	Total length range in inches	Estimated population	95 % limits	Marked seined fish	Length-range
White crappie a)	732	691	12	3.8-12.7	20,188	±26,221	50	
b)	334	323	9	7.0-12.7	5,569	±10,496		
Black crappie a)	287	270	7	4.1-12.6	5,044	±14,250	12	
b)	237	230	7	7.0-12.6	3,672	±10,372		
Channel catfish	110*	25	2	11.0-23.7	2,132 (rotenone estimate)			
Green sunfish	104	92	12	4.9-10.0	388	± 503	9	
Bluegill	248	244	3	4.0-7.9	9,182	± [illegible]	150	2.2-5.1 ($\hat{P}$ = 14,260)**
Black bullhead	25	22	1	6.2-13.0	-			
Largemouth bass	28	24	4	6.8-15.1	1,70[illegible]		13	
Redear sunfish	7	7	0				21	
Golden shiner	4	4	0		7,152*	± [illegible]	210	4.2-6.6
Orangespotted sunfish	9	9	0				19	
Longear sunfish	2	2	0				9	($\hat{P}$ = 20)
	2,127	1,943	57				493	

* includes rotenone collection
** based on seine collections

Table 9. Stringtown Sub-Prison Lake - July 1954 - population estimates based on trap and rotenone collections.

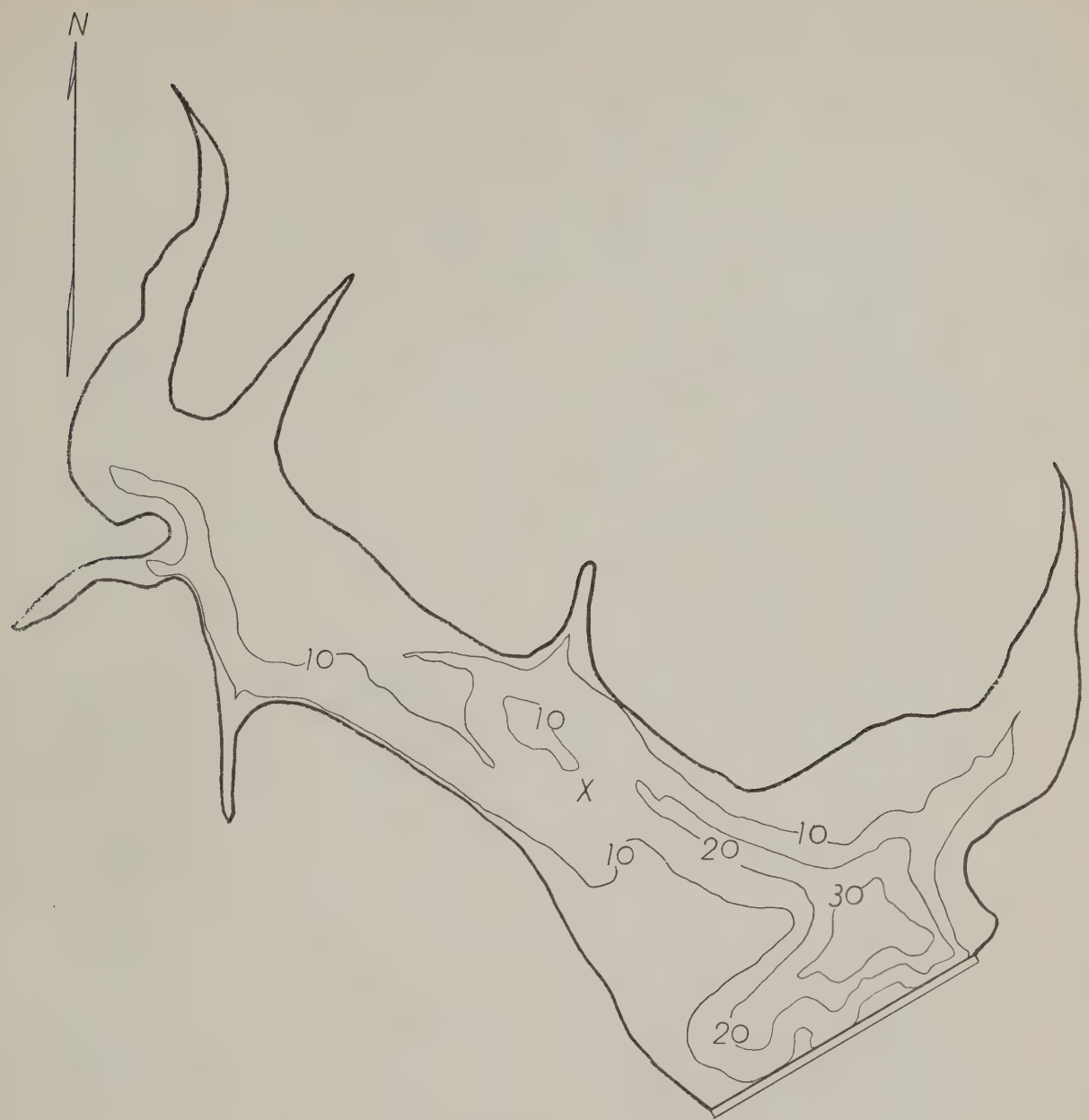
Species	Length range	Number/acre	Pounds/acre
White crappie	3.8-12.7	310	65
Black crappie	4.1-12.6	78	18
Channel catfish	11.0-23.7	33	25
Bluegill	4.0-7.9	140	14
Largemouth bass	5.0-16.2	26	18
Golden shiner	4.2-6.6	110	5
Miscellaneous *	---	---	4
Total			149

* Green sunfish, black bullhead, redear sunfish, orangespotted sunfish, longear sunfish.

Fairfax City Lake

Fairfax City Lake is a 90-acre water supply reservoir located in Township 25N, Range 5E, Osage County. Impounded in 1938, the lake averages about 10 feet in depth, with a maximum depth of 33 feet (Figure 5). The drainage area encompasses 4800 acres of hilly, tallgrass prairie. On June 6, 1953, one-half of the lake was treated with rotenone, and it was estimated that approximately 75 percent of the fish population was eliminated.

Trapping and seining operations were carried on from July 20 to August 4, 1954. Trapping results were disappointing, and a realistic estimate was obtained only for the carp population (Table 10). Carp spawned following the rotenone treatment in early June of 1953, but did not experience the rapid growth observed at other lakes, averaging only six inches at the end of the first year. Yearling carp averaged 7.5 inches on August 1, with an estimated population of 12,125 (242 pounds/



FAIRFAX CITY LAKE

90 ACRES AT SPILLWAY LEVEL

X CENTRAL RELEASE POINT

DEPTH CONTOURS IN FEET

¼ MILE

Table 10. Summary of trap and seine catches in Fairfax City Lake July 20-August 4, 1954. Population estimates based on trap catches (323 trap lifts).

Species	Number captured	Number marked at large 4 Aug.	Number recaptured	Total length range in inches	Estimated population	95 % limits	Marked seined fish	Length-range
Carp	2,364	2,118	102	4.0-13.0	12,125	± 4,835	49	
Black crappie	241	193	5	4.4-8.2	5,196	± ?		
Bluegill	80	67	3	3.5-5.8	-	-	83	
Green sunfish	46	43	1	4.7-6.8	-	-	5	
Black bullhead	7	6	1	9.1-12.9				
Longear sunfish	3	3	0	4.1-4.7			11	
Largemough bass							4	(2.9-9.8)
Channel catfish	1			18.5				
Redear sunfish							11	(2.3-2.8)
Gizzard shad							100	(3.1-9.5)
Drum							1	3.8
Orangespotted sunfish							4	
Golden shiner							4	
	2,742	2,430	112				272	

surface acre) (Figure 6). Young-of-the-year were scarce and averaged 3.5 inches in length. In contrast, young-of-the-year carp in Ardmore City Lake averaged about 6 inches, and the standing crop was estimated at 630 pounds/acre on 25 June. The apparent slow growth in Fairfax might be attributed to high mortality of faster-growing individuals, a short 1953 growing season, and a much lower carrying capacity than that of Ardmore City Lake. Observations at other lakes indicate that the explosive expansion of the carp population following partial population removal is quickly succeeded by a decline in growth rate and numbers, and that spawning success in the second year is low. The carp population in Fairfax seems to be paralleling this cyclic pattern.

Black crappie reproduction was highly successful in 1954 and young-of-the-year captured in wire traps in July averaged 5 inches in length. Young-of-the-year gizzard shad and bluegill were also abundant.

Pawhuska City Lake

Pawhuska City Lake is located in Township 25N, Range 8E, Osage County, and serves as a municipal water supply. At normal level the lake comprises 95 surface acres, and averages about 16 feet in depth, with a maximum depth of 36 feet. During the period of trapping, July 23 to August 19, 1954 the lake was about 10 feet below normal, reducing the surface area to about 80 acres. The shoreline was barren, and patches of Chara in 2 to 7 feet of water were the only submerged aquatics present.

A total of 3,133 fish were captured in wire traps (Table 11), including 959 black crappie, 887 white crappie, and 741 bluegill. Estimates revealed large populations of yearling black crappie ($\hat{P}$ = 11,400) and white crappie ($\hat{P}$ = 19,000) which had survived rotenone treatment of 50 percent of the lake in June, 1953. There were about 4,000 black and white crappie over 7 inches in length, which was

Fairfax City Lake - 90 surface acres

Population study - 20 July - 4 August

323 trap lifts

Yearling carp population — Av. TL = 7.44"; Av. Wt. = 0.18 lbs.

first year growth = 6.0"

Length-weight relationship - $\log W = -3.8149 + 2.7085 \log L$

		Av. TL	
Black crappie			
Age-group 0	4.4"-6.0"	5.07"	241 fish
Bluegill			
Age-group 0	1.9"-3.0"	2.4"	52 fish
I	3.0"-5.4"	4.1"	111 fish
Redear sunfish			
Age-group 0	2.3"-2.8"	2.6"	11 fish
Gizzard shad			
Age-group 0	3.1"-4.5"	3.8"	87 fish
I	7.2"-9.5"	8.3"	13 fish

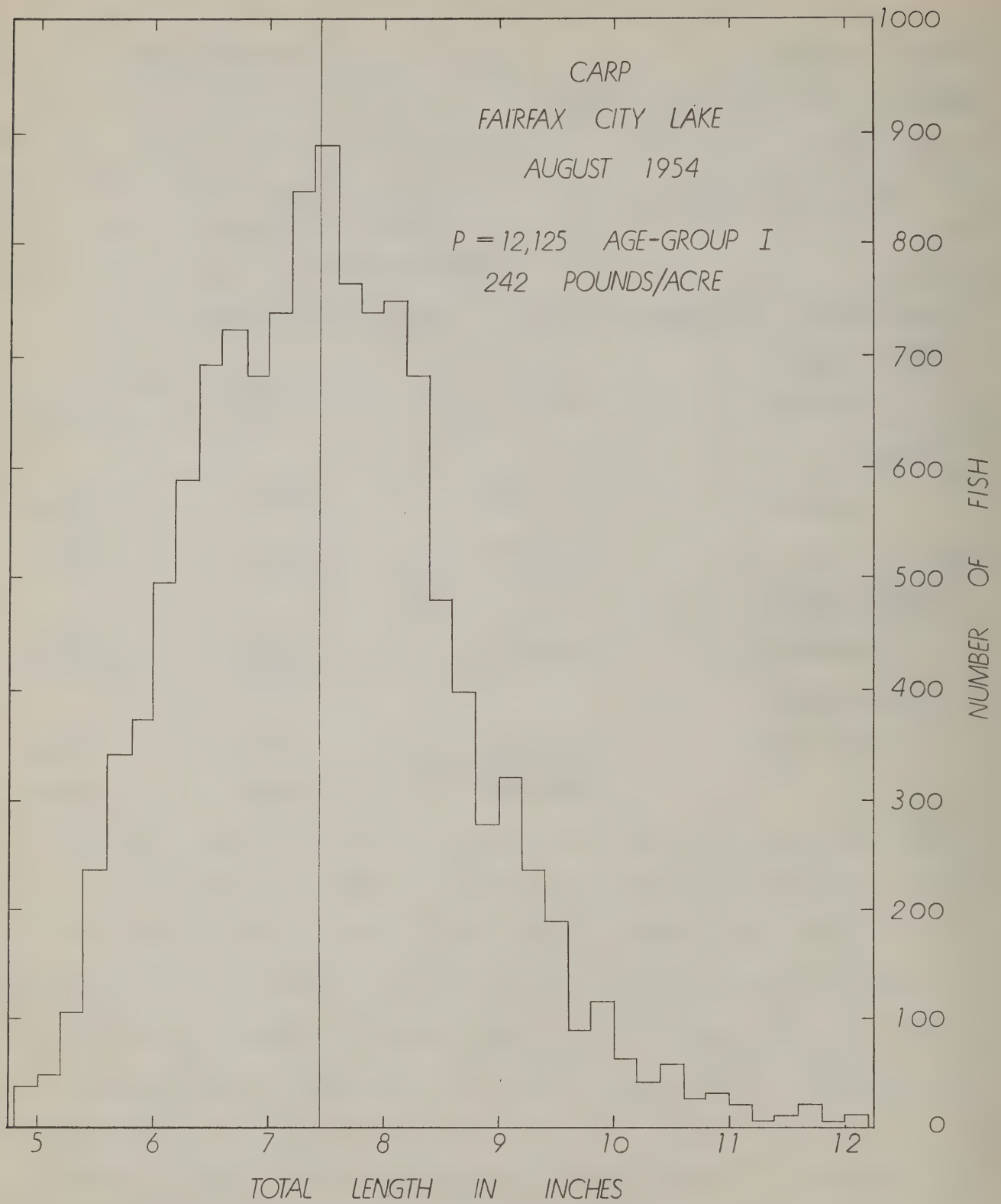


Figure 6. Length-frequency of estimated carp population in Fairfax City Lake, August 1954, based on 2,335 actual length measurements. Grouped in 0.2 inch length intervals.

Table 11. Summary of trap and seine catches in Pawhuska City Lake July 23-August 19, 1954. Population estimates based on trap catches (401 trap lifts).

Species		Number captured	Number marked at large 19 Aug.	Number recaptured	Total length range in inches	Estimated population	95 % limits	Marked seined fish	Length-range
Black crappie	a)	400	367	4	3.9-6.9	11,400	± ?	155	
	b)	559	485	40	7.0-13.0	3,283	± 475	0	
White crappie	a)	702	512	7	5.0-6.9	19,040	±43,130	159 + 43 trapped	(4.2-4.9")
	b)	142	117	9	7.0-11.7	862	± 1,626	5	
Bluegill	a)	28	28	0	2.3-3.9	-		31	
	b)	713	669	14	4.0-9.6	16,345	±14,874	3	
Spotted bass		36	35	6	6.7-16.4	127	± 506	1	
Longear sunfish		246	236	15	3.7-5.8	1,988	± 2,037	37	(2.1-5.1)
Redear sunfish		112	110	11	4.2-11.7	582	± 842	9	(2.2-5.6)
Green sunfish		62	57	5	4.6-9.3	343	± ?	5	(2.4-4.8)
Yellow perch		38	37	1	6.2-7.8	-		4	(4.0-6.6)
Warmouth		36	36	0	4.3-8.0	-		-	
Largemouth bass		6	6	0	8.2-21.7	-		4	(8.5-10.0)
Channel catfish		4	4	0	6.5-9.3	-			
Flathead catfish		2	2	0	14.4-14.6	-			
Hybrid sunfish		4	4	0	5.1-8.0	-			
		3,090	2,705	112				456	

equivalent to 18 pounds per surface acre. Redear sunfish up to 11.7 inches long, weighing 21 ounces, were caught - the largest reported in the state. One largemouth bass, weighing 6 pounds, was the largest fish taken in a wire trap during the summer.

There were an estimated 16,000 bluegill and 600 redear sunfish over 4 inches long in the lake, and about 2,000 longear sunfish from 3.7 to 5.8 inches in length. Estimates of other species were unreliable or impossible because of no recaptures.

Pawhuska City Lake - August 1954

Fish population estimates — Normal acreage - 95

Gross approximations — August 1954 - 80

4,000	catchable crappie (7" +)
16,000	bluegill over 4.0"
100	catchable spotted bass
2,000	longear sunfish 4-6"
600	redear sunfish over 4.3"
350	green sunfish over 4.6"

No estimate - Largemouth bass, channel catfish, flathead catfish, warmouth yellow perch

20,000	white crappie 5-7"
11,000	black crappie 4-7"

Age-group I

Notable growth increase in -

yearling white crappie in 1953-54

" warmouth " "

" bluegill " "

" yellow perch " "

Other species showed no appreciable change.

Catchable black crappie outnumbered whites - 4 to 1

Yearling white crappie outnumbered blacks - 2 to 1

50% population reduction 15 June 1953

Population estimate 23 July - 19 August 1954

Table 12. Summary of fishes captured by wire traps and seines during population studies on four Oklahoma lakes in 1954.

Lake	Sampling period(s) inclusive	Total number fish captured	No. of trap lifts	Fish/ trap lift	Marked fish at large at termination	No. of fish recaptured	No. of seined fish marked
Ardmore City	6/9-6/25	10,189	401	25.4	7,676	2,022	-
	12/8-12/29	5,010	285	17.6	4,386	50	-
Stringtown Sub-Prison	6/29-7/14	2,127	384	5.5	1,943	57	493
Fairfax City	7/20-8/4	2,742	323	8.5	2,430	112	272
Pawhuska City	7/23-8/19	3,133	401	7.8	2,747	112	456
Total or average		23,201	1,794	12.9	19,182	2,353	1,221

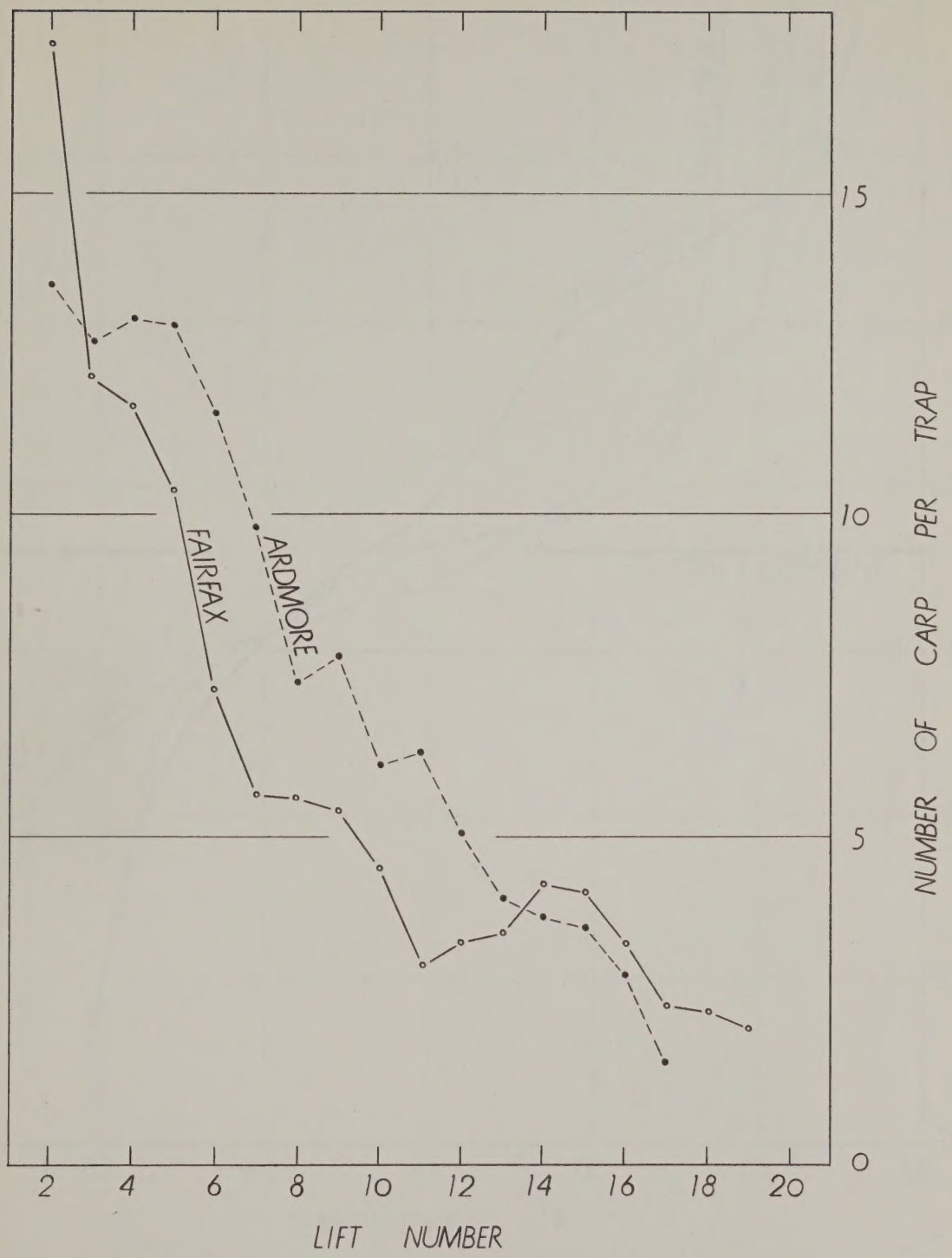
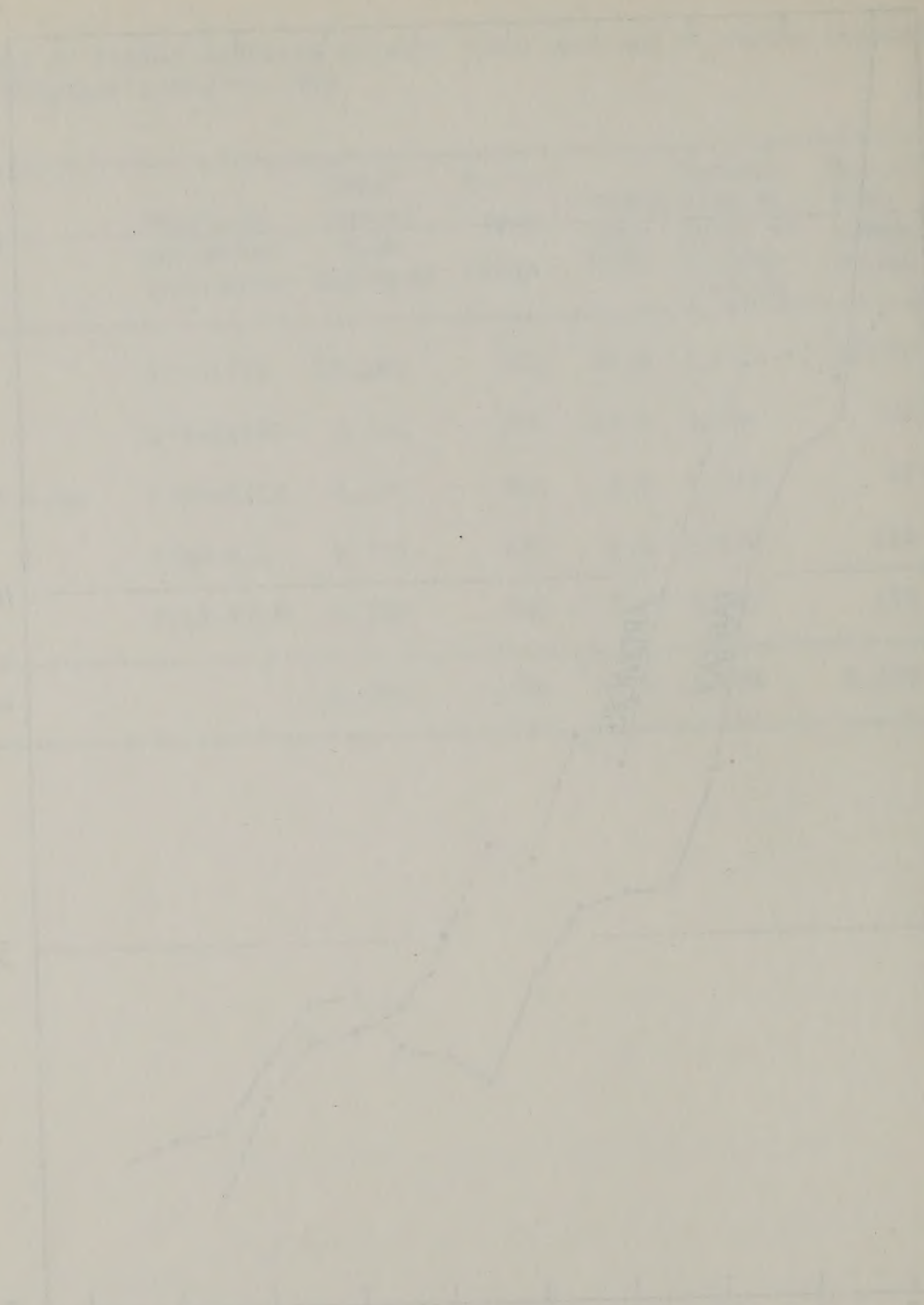


Figure 7. Rate of capture of carp per wire trap per lift in Ardmore City Lake (9-25 June) and Fairfax City Lake (20 July - 4 August). Based on three-lift moving averages.



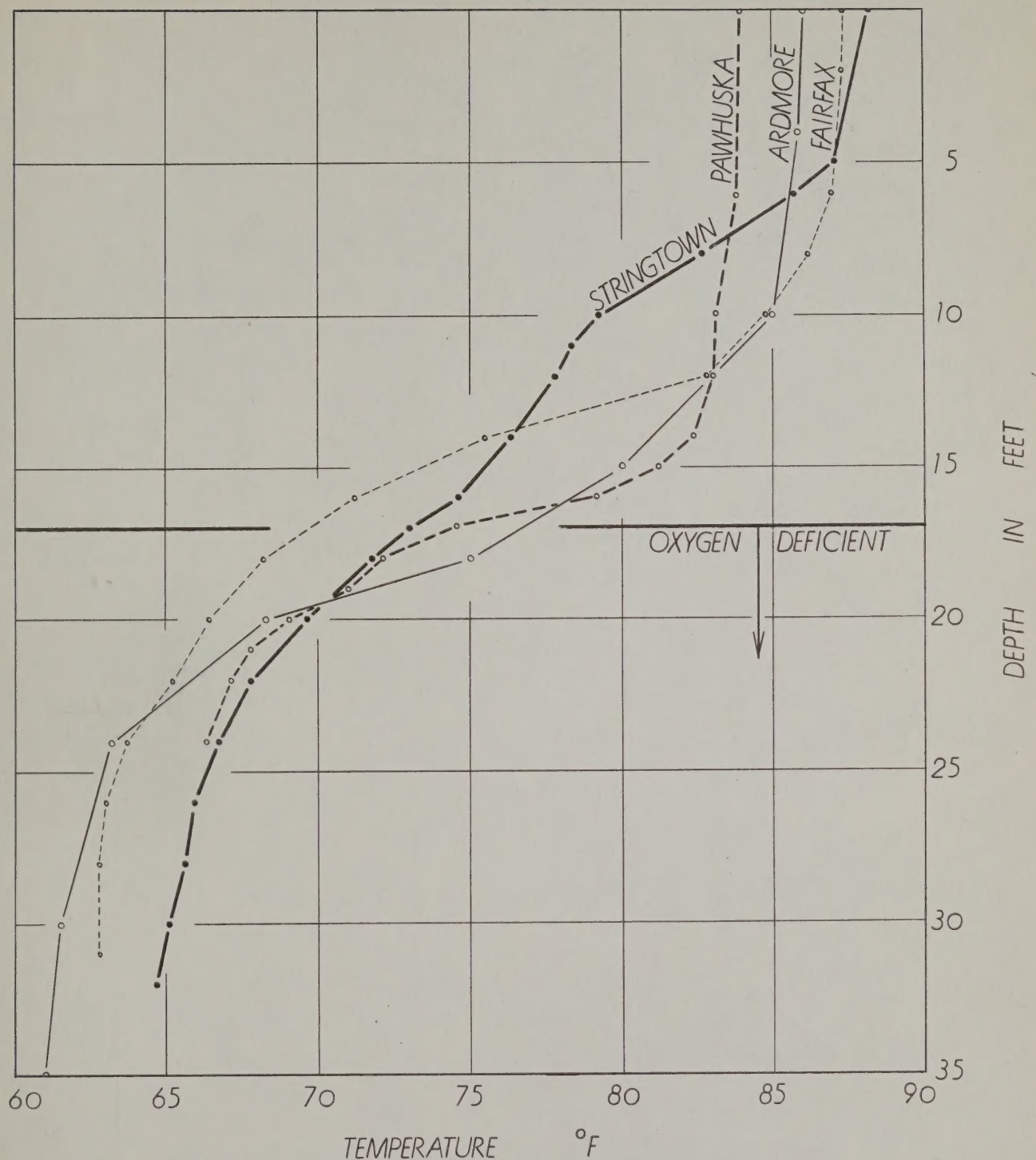


Figure 8. Temperature profiles of Ardmore City Lake (15 June), Stringtown Sub-Prison Lake (7 July), Fairfax City Lake (27 July), and Pawhuska City Lake (28 July). Summer, 1954.

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